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clusions drawn from the rate of expansion, as stated above.

But the most striking proof possible of the penetration of the salt is afforded by the following simple experiment. By dividing a *Spirogyra* filament into several portions it was found that it was plasmolyzed in .2M  $\text{CaCl}_2$  and in .38M  $\text{NaCl}$  but neither in .195M  $\text{CaCl}_2$  nor in .375M  $\text{NaCl}$ . On mixing 100 c.c. .375M  $\text{NaCl}$  with 10 c.c. .195M  $\text{CaCl}_2$  and placing other portions of the same filament in it, prompt and very marked plasmolysis occurred. Here we arrive at the extraordinary result that *by mixing together two solutions neither of which is able to plasmolyze we produce a solution which plasmolyzes strongly*. The experiment is so simple and striking that it is admirable for class-room demonstration.

It may be noted that in this experiment we add to a solution of  $\text{NaCl}$  a solution of  $\text{CaCl}_2$  which is of much lower osmotic pressure. It is evident that although the addition of the  $\text{CaCl}_2$  lowers the osmotic pressure, it nevertheless increases the plasmolyzing power of the solution considerably. Evidently it can do this by preventing the  $\text{NaCl}$  from penetrating the protoplasm or the two salts may mutually prevent each other from going in. The behavior of the cell indicates that in most cases the latter alternative is to be preferred. This will be fully discussed in another paper.

In the course of time the cells in the mixture of  $\text{NaCl}$  and  $\text{CaCl}_2$  may expand, but this occurs very much more slowly than in pure  $\text{NaCl}$ . The appearance of the cell then shows in the clearest manner that it is not  $\text{NaCl}$  alone which has penetrated and caused the expansion, but rather  $\text{NaCl}$  and  $\text{CaCl}_2$  together. This is evident from the fact that the effects which are characteristic of pure  $\text{NaCl}$  are entirely absent. But though they eventually penetrate they do so slowly and the effect of slow penetration is very different from that produced by sudden penetration and this may largely explain why they act as antidotes to each other.

It is evident that while the mechanism of antagonistic action may depend largely on the mutual action of the antagonistic salts in

preventing each other from entering we must take into account their effect on the protoplasm within the cell as well as their effect on the plasma membrane.

Marine algæ give similar results.

The chief conclusions are as follows:

1. The usual method of determining osmotic pressure by plasmolyzing in salts of Na and K is very erroneous. Salts of Ca give more nearly the true osmotic pressure.

2. Since one substance may greatly affect the penetration of another it is unsafe to use the common method of adding a toxic to a non-toxic substance and judging the penetration of the former by the plasmolytic action of the mixture.

3. It is possible to state which salts penetrate and at what rate of speed, and also how various salts affect the permeability of the plasma membrane.

4. From these data we have a definite clue to the nature of the plasma membrane. Since all the salts studied penetrate it seems certain that the membrane can not be lipoid because these salts are not soluble in lipoid. Its behavior toward balanced solutions (together with other facts) indicates unmistakably that the membrane is proteid in nature.

5. Antagonistic salts such as  $\text{NaCl}$  and  $\text{CaCl}_2$  hinder or prevent each other from entering. To such an extent is this true that by choosing solutions of  $\text{NaCl}$  and of  $\text{CaCl}_2$  which are not quite strong enough to plasmolyze we produce by mixing them together a solution which plasmolyzes strongly.

The fact that these salts hinder or prevent each other from entering may explain why they act as antidotes to each other. But since they may eventually penetrate to some extent we must attach importance to their effect on the protoplasm within the cell as well as to their effect on the plasma membrane. These two effects may be very similar.

W. J. V. OSTERHOUT

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INDIANAPOLIS MEETING OF THE AMERICAN CHEMICAL SOCIETY

It has become almost monotonous to write that a meeting of the American Chemical Society was

the largest so far held, but again the Indianapolis meeting of the society has exceeded its summer record with 432 members and guests present.

The meeting was very successful, both in the matter of papers presented and social enjoyment. The hospitality of the local section knew no bounds and the members were treated to automobile rides, luncheons, smokers and concerts too numerous to be detailed. Interesting mementoes were given to each member that the Indianapolis meeting might not be forgotten. They consisted of watch fobs carrying the society insignia, steins carrying the society emblem in cobalt blue and gold, and bakelite cigar holders.

The meeting opened on Wednesday morning with general addresses by Charles Baskerville, on "The Chemistry of Anesthetics"; by W. Lash Miller, on "The Chemical Philosophy of High School Text-books," and by W. F. Hillebrand, on "The Quality of Platinum Utensils for Laboratory Purposes."

On Thursday evening a public lecture was given by A. D. Little at the German House, on "The Earning Power of Chemistry."

The banquet on Friday evening was addressed by Governor Marshall, of Indiana, and Ex-Vice-President Fairbanks and was graced by the presence of many ladies, including Mrs. Marshall.

The various manufacturing plants around Indianapolis threw open their doors to the chemists and in many instances gave special entertainment to them.

The papers presented at the meeting follow by title and by abstract so far as abstracts have been procured.

CHARLES L. PARSONS,  
*Secretary*

*Chemistry of Anesthetics*: CHARLES BASKERVILLE, Ph.D., F.C.S., professor of chemistry, College City of New York. Printed above.

DIVISION OF AGRICULTURAL AND FOOD CHEMISTRY  
H. E. Barnard, *chairman*

B. E. Curry, *secretary*

*Composition of the Drainage Water of a Soil with and without Vegetation*: T. LITTLETON LYON and JAMES A. BIZZELL.

Drainage water was collected from twelve large tanks, a description of which has previously been published. Each tank is slightly over four feet square and four feet deep with a capacity for about three and one half tons of soil. The drainage collected between May 23, 1910, and May 1,

1911, is taken as the basis for a study of the influence of vegetation on the removal of mineral matter in the drainage water.

Three tanks contained no plants, four were planted to corn and two to oats.

The nitrogen in the corn crop plus that in the drainage water from tanks cropped to corn amounted to 151 pounds per acre. That in the oat crop and drainage from the oat tanks amounted to 103 pounds per acre. There were, therefore, 48 pounds per acre more available nitrogen in the corn soil than in the oat soil. This is in line with the results of previous work by the writers, which indicated either that the corn plant has a stimulating effect on the process of nitrification, or that it utilizes to a large extent nitrogen in forms other than nitrates, or that both of these phenomena occur.

The bicarbonates were large in amount, but the much greater loss of basic material from the uncropped than from the cropped soil was removed mainly in the form of nitrate and not as bicarbonate. Any system of soil management which results in a decreased removal of nitrates in the drainage water will probably effect a conservation of bases in the soil.

*The Influence of the Reaction of Solution on the Development of Wheat Seedlings*: J. F. BREAZEAL and J. A. LEClerc.

*Cold Storage and the Cryabiotic Point*: W. D. RICHARDSON.

It is proposed to call the temperature below which the growth and reproduction of the lower microorganisms is prevented by the solid condition of the medium the "cryabiotic point," the derivation being obvious. The growth and reproduction of microorganisms implies increase in size, and such a growth is effectually resisted by such a solid medium as ice. The cryabiotic point for water would, therefore, be its freezing point 0° C. For media containing common salt, in which media bacteria thrive at temperatures much below 0° C., the cryabiotic point would be the cryohydric point of salt and water, or minus 22° C. For butter the cryabiotic point would also be approximately the cryohydric point of salt and water, or minus 22° C. For meats the cryabiotic point would be the temperature at which enough water had frozen out in the pure state to leave a solution so concentrated as to be a solid in the ordinary sense of the word.

In the past and current discussions on cold storage there has been much confusion owing to a failure to distinguish between temperatures used

for the storage of foods in which the foodstuffs were not solidly frozen, and hence in which bacterial activities were not absolutely stopped, although they may have been retarded, and those temperatures in which the foodstuffs were frozen so solidly that bacterial growth and reproduction became impossible. It is believed that the introduction of the expression "the cryabiotic point" will serve to distinguish between the two cases in discussions on the subject of cold storage.

*The Composition of Canned Tomatoes:* E. H. S. BAILEY and H. L. JACKSON.

The authors have made some examinations of quite a large number of brands of canned tomatoes on the market, especially with reference to the amount of solids in proportion to the juice. The solids in the juice are also determined as well as the ash. Some methods of standardizing canned tomatoes, by a determination of the solids and the ash are also discussed.

*The Chemical Changes which take place during the Spoilage of Tomatoes, with Methods for Detecting this Spoilage in Tomato Products:* R. F. BACON and P. B. DUNBAR.

*Two New Pieces of Apparatus; (a) Apparatus for the Continuous Extraction of Liquids with Immiscible Solvents Lighter than Water, (b) A Compact Apparatus for Quantitative Determinations based on the Measurement of an Evolved Gas:* R. F. BACON and P. B. DUNBAR.

*The Action of Non-acid Foods on Tin Containers with Special Reference to Canned Shrimp:* R. F. BACON and W. D. BIGELOW.

*Determination of Tin in Food Products:* EDWARD GUDEMAN.

*A Chemical Study of Certain "Sandhill" Soils of South Carolina:* T. E. KEITT.

*The Volatile Acids of Corn Silage:* ARTHUR W. DOX and R. E. NEIDIG.

*The Arsenic Content of Shellac and the Arsenical Contamination of Food Products from that Source:* H. B. SMITH.

*The Solubility of CaO in Contact with Clay:* B. E. CURRY.

Clay, known as fuller's earth, was kept in contact with water until equilibrium was established. From the solubility of the CaO it has been determined that the lime and clay form two series of solid solutions, the first extending from 0 per cent. to about 3 per cent. CaO and the second extending over a range from about 25 per cent. to 45 per cent. CaO.

*A Short Method for the Determination of Soluble Arsenic in Commercial Lead Arsenates:* T. O. SMITH and B. E. CURRY.

A 2-gram sample of lead arsenate is stirred continuously for 18 hours with 500 c.c. of water. When a correction is made for the solubility of lead arsenate the results are comparable to those obtained by the A. O. A. C. method in 10 days. When 500 c.c. of water is used the addition of 46 per cent. to the results give the same value obtained by the A. O. A. C. method.

By making a small correction for the solubility of lead arsenate the amount of soluble arsenic not combined with lead is obtained. The results obtained by the A. O. A. C. method include a large amount of arsenic combined with lead.

*Methods of Estimating Fats in Tissue:* W. KOCH.

For purposes of biological interpretation of analytical results it is necessary to distinguish between neutral fats and combined fats or lipoids. None of the present methods of estimating fat, including the official method, permit of this. The method of indirect estimation suggested by Koch and Carr obviates this difficulty. Further data on the comparison of this method with others were given and will be published in detail later.

It may be stated, however, that the Kumagawa and Suto method gives results which are below the actual quantity of total fatty acid on account of incomplete saponification of combined fats, especially in such tissues as liver and brain. The Koch and Carr method gives results which on account of certain sources of error, that it has not yet been possible to eliminate, gives results which are probably somewhat too high.

*The Distribution of Organic Constituents in Soils:* OSWALD SCHREINER and ELBERT C. LATHROP.

*Dihydroxystearic Acid in Good and Poor Soils:* OSWALD SCHREINER and ELBERT C. LATHROP.

*Studies on Organic Soil Nitrogen:* ELBERT C. LATHROP and BAILEY E. BROWN.

*The Effect of Phosphorus Manuring on the Amount of Inorganic Phosphorus in Flat Turnip Roots:* BURT L. HARTWELL and FREDERICK S. HAMMET.

As a result of chemical and microscopical examinations of flat turnip roots the percentage of inorganic phosphorus seems to be influenced more than that of the total phosphorus, by the amount of available phosphorus in soils; and that its determination therefore in the turnips is likely to be more useful for securing indications of the

relative phosphorus deficiencies in soils than the determination of total phosphorus which had heretofore been made use of at that station in ascertaining the relative phosphatic requirements.

*Composition of the Timothy Plant at Different Stages of Growth:* L. D. HAIGH and P. F. TROWBRIDGE.

The following table shows the per cents. of plant food constituents on the dry basis in the timothy plant at different stages. The per cent. of moisture is highest in the young timothy plant and shows a steadily declining value up to full ripening.

	Before Head- ing Out	After Head- ing Out	Blos- soming	Ripe
Protein (N $\times$ 6.25).....	6.87	5.39	4.53	4.80
Ether soluble (fat).....	3.13	3.00	1.89	2.20
Crude fiber.....	26.69	28.28	38.10	27.43
Ash.....	7.50	6.30	5.24	4.58
Nitrogen free extract....	55.80	57.03	58.24	61.00

The plant food constituents other than carbohydrates have their highest percentage value before the head forms, as these are taken up most rapidly at this time. After heading out the carbohydrates are formed more rapidly, so that the percentage values of the other constituents decrease even while they are still being taken up.

The timothy plant, as a whole, takes up large amounts of nitrogen and mineral matter in the young stages but the amounts at any stage become less as ripening approaches. Nitrogen-free extract is formed at an increasing rate as the plant ripens.

The heads of the timothy increase in all its constituents during growth and ripening. As the seed ripens, a large increase of phosphoric anhydride occurs. This increase is not at the expense of some other part, but a distinct addition from the soil. From blossoming to the nearly ripe condition the phosphoric anhydride increases from 27.01 to 50.17 pounds per acre in the total plant.

The stalks increase in amount of total dry matter during growth and ripening, but a decrease occurs in the amount of nitrogen and ether soluble material during ripening. This is due, partly to dead leaves falling from the stem, and partly to transference of this material to the heads.

The bulbs increase in dry matter during growth, the amount then remains constant during ripening. The principal constituents added are nitrogenous matter and nitrogen-free extract, but no starch is formed in the bulbs at any stage. The potassium

oxide and phosphoric anhydride remain about constant in amount from the time of heading to full ripening.

A large amount of potassium oxide especially is required for the growth of the timothy plant. One ton of air-dry timothy hay cut when nearly ripe will remove twenty-five pounds of potassium oxide and sixteen pounds of phosphoric anhydride from the soil.

*The Detection and Determination of Small Quantities of Ethyl Alcohol, Methyl Alcohol and Formic Acid:* R. F. BACON.

*The Determination of Malic Acid:* P. B. DUNBAR and R. F. BACON.

*The Detection of Benzoic Acid in Coffee Extract:* HERMANN C. LYTHGOE and CLARENCE E. MARSH.

Coffee extract contains a substance which will give a reaction for benzoic acid. Acidify the sample, extract with ether, extract the ether with ammonia and evaporate the ammoniacal solution to a small volume and add manganese sulphate which will remove the disturbing substance. Filter, add ferric chloride and in the presence of benzoic acid a dark greenish precipitate occurs. Evaporate to dryness, sublime, take the melting point of some of the crystals and prepare the ammonium salt with the rest which will give the characteristic precipitate with ferric chloride if benzoic acid is present.

*The Composition of Tincture of Ginger:* H. C. LYTHGOE and L. I. NURENBERG.

Several tinctures were made from Jamaica, African, Cochin and oleoresin gingers using alcohol of varying strength (approximately 95 per cent., 75 per cent., 50 per cent. and 25 per cent.), with the view of ascertaining the influence upon the composition. It was found that alcohol of 70 per cent. or more, especially in the case of Jamaica ginger, gave approximately the same amount of alcohol-soluble solids. The total and water-soluble solids increase as the strength of alcohol used decreases, and when the latter goes below 70 per cent. the alcohol soluble solids decrease. Of the tinctures made from oleoresin ginger, the one made from 95 per cent. alcohol was the only one which showed any appreciable amount of ginger resins.

*The Volatile Acidity of Tragacanth and other Gums:* W. O. EMERY.

*Akron (Ohio) Water: Home Treatment for Bath and Laundry:* CHARLES P. FOX.

(To be continued)